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SERIAL NO. _____
JUTTU, SMITH

PATENT APPLICATION
STC-02-0004

WHAT IS CLAIMED AS NEW AND DESIRED TO BE SECURED BY LETTER OF
PATENT OF THE UNITED STATES OF AMERICA IS:

1. A process for the aromatization of hydrocarbons comprising:
 - a) contacting an alkane containing 2 to 6 carbon atoms per molecule with at least one catalyst containing an aluminum-silicon-germanium zeolite on which platinum has been deposited; and
 - b) recovering the aromatic product.
2. The process of claim 1 wherein the silicon-germanium to aluminum atomic ratio is greater than 25:1.
3. The process of claim 1 wherein the silicon-germanium to aluminum atomic ratio in the range of from 45:1 to 250:1.
4. The process of claim 1 wherein the silicon-germanium to aluminum atomic ratio in the range of from 50:1 to 100:1.
5. The process of claim 1 wherein the silica to germania ratio is in the range of from 100:1 to 8:1.
6. The process of claim 1 wherein the silica to germania ratio is in the range of from 50:1 to 10:1.

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7. The process of claim 1 wherein the silica to germania ratio is in the range of from 25:1 to 11:1.

8. The process of claim 1 wherein platinum is present in the range of from 0.05% to 3%.

9. The process of claim 1 wherein platinum is present in the range of from 0.2% to 2%.

10. The process of claim 1 wherein platinum is present in the range of from 0.2% to 1.5%.

11. The process of claim 1 wherein the contact between the alkane and the catalyst is at a space velocity in the range between 0.1 and 100 h⁻¹.

12. The process of claim 1 wherein the contact between the alkane and the catalyst is at a temperature in the range between 200 and 600°C.

13. The process of claim 1 wherein the contact between the alkane and the catalyst is at a pressure in the range between 5 and 215 psia.

14. The process of claim 1 wherein the zeolite has a MFI, FAU, TON, MFL, VPI, MEL, AEL, AFI, MWW or MOR structure.

15. The process of claim 1 wherein the catalyst additionally contains sulfur.

16. The process of claim 1 wherein the alkane additionally contains sulfur.

17. A process for synthesizing an aluminum-silicon-germanium-platinum zeolite catalyst comprising:

- a) preparing a zeolite containing aluminum, silicon and germanium;
- b) depositing platinum on the zeolite; and
- c) calcining the zeolite.

18. The process of claim 17 wherein the platinum is deposited by cationic exchange.

19. The process of claim 17 wherein the platinum is deposited by impregnation.

20. The process of claim 17 wherein the zeolite has an MFI, FAU, TON, MFL, VPI, MEL, AEL, AFI, MWW or MOR structure.

21. The process of claim 17 wherein the catalyst is subsequently treated first with hydrogen, second with a sulfur compound; and then again with hydrogen.

22. An aluminum-silicon-germanium-platinum zeolite catalyst for aromatization of hydrocarbons comprising:

- a) a microporous aluminum-silicon-germanium zeolite; and
- b) platinum deposited on the microporous aluminum-silicon-germanium-platinum.

23. The catalyst of claim 22 wherein the silicon-germanium to aluminum atomic ratio is greater than 25:1.

24. The catalyst of claim 22 wherein the silicon-germanium to aluminum atomic ratio in the range of from 45:1 to 250:1.

25. The catalyst of claim 22 wherein the silicon-germanium to aluminum atomic ratio in the range of from 50:1 to 100:1.

26. The catalyst of claim 22 wherein the silica to germania ratio is in the range of from 100:1 to 9:1.

27. The catalyst of claim 22 wherein the silica to germania ratio is in the range of from 50:1 to 10:1.
28. The catalyst of claim 22 wherein the silica to germania ratio is in the range of from 25:1 to 11:1.
29. The catalyst of claim 22 wherein platinum is present in the range of from 0.05% to 3%.
30. The catalyst of claim 22 wherein platinum is present in the range of from 0.2% to 2%.
31. The catalyst of claim 22 wherein platinum is present in the range of from 0.2% to 1.5%.
32. The catalyst of claim 22 wherein the pore size of the zeolite is in the range from 5 to 100 angstroms.
33. The catalyst of claim 32 wherein the pore size of the zeolite is in the range from 5 to 50 angstroms.
34. The catalyst of claim 33 wherein the pore size of the zeolite is in the range from 5 to 20 angstroms.

35. The catalyst of claim 22 wherein the zeolite has a MFI, FAU, TON, MFL, VPI, MEL, AEL, AFI, MWW or MOR structure.

36. The catalyst of claim 22 wherein the catalyst additionally comprises a sulfur compound.

37. The catalyst of claim 36 wherein the sulfur compound is H₂S, C_nH_{2n+2}S where n = 1-20, C_nH_{2n+1}S₂ where n = 2-22 or C_nH_{2n+1}S where n = 2-22.

38. The catalyst of claim 22 wherein the catalyst is represented by the formula M[(SiO₂)_x(XO₂)_y(YO₂)_z]Z⁺_{y/n} where M is a noble metal, X is a tetravalent element, Y is a trivalent element, Z is a cation with a valence of n, x varies from 0-0.15 and y is 0-0.125.

39. The catalyst of claim 38 wherein M is platinum or gold.

40. The catalyst of claim 38 wherein X is titanium, germanium or tin.

41. The catalyst of claim 38 wherein Y is boron aluminum, gallium indium or tellurium.

42. The catalyst of claim 38 wherein Z is H⁺, Na⁺, K⁺, Rb⁺, Cs⁺, Ca²⁺, Mg²⁺, Sr²⁺ or Ba²⁺.

43. The catalyst of claim 22 wherein the catalyst is of the formula |H⁺Pt|[Si_{9.1}Ge₄Al₁O_{19.2}]-MFI.

44. The catalyst of claim 22 wherein its X-ray diffraction pattern includes the values given in Table 5 of this specification.

45. A process for pretreating a catalyst for aromatization of hydrocarbons comprising:

- a) selecting an aluminum-silicon-germanium zeolite on which platinum has been deposited;
- b) treating the zeolite with hydrogen;
- c) treating the zeolite with a sulfur compound; and
- d) treating the zeolite a second time with hydrogen.

46. The process of claim 45 wherein the zeolite is bonded with amorphous alumina prior to the first treatment step.

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47. The process of claim 45 wherein the sulfur compound is H₂S,
C_nH_{2n+2}S where n = 1-20, C_nH_{2n+1}S₂ where n = 2-22 or C_nH_{2n+1}S where n = 2-
22.